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ART. I. *Experiments on the use of Metallic Ligatures, as applied to Arteries.* By HENRY S. LEVERT, M. D. of Alabama.

DR. JONES, in the course of his interesting experiments "on the process employed by nature in suppressing the hæmorrhage from divided and punctured arteries, and on the use of the ligature," arrived at a very striking result; one that seemed likely to lead to an important innovation in the application of the ligature. He found that if a ligature be drawn around an artery with a degree of force sufficient to divide its internal and middle coats, the subsequent inflammation and effusion of coagulable lymph produced its obliteration, and the ligature might be removed, and the wound healed by the first intention.

Had these conclusions been found by subsequent inquirers to be correct, we might have considered it a degree of perfection in the use of the ligature, beyond which we can never hope to proceed; but unfortunately, others who have investigated this subject, have arrived at conclusions somewhat different, and have found that although an evident contraction of the calibre of the vessel, was the almost invariable result of an application of the ligature as recommended by Dr. Jones; yet its complete obliteration was seldom observed.

Mr. B. TRAVERS imagined that the cause of failure in these cases proceeded from a too speedy removal of the ligature, before the sides of the vessel had time to contract the slightest adhesions, and improving upon the idea of Dr. Jones, has advised that it be suffered to remain on the vessel for a short time, until adhesions should be

established between the opposing sides; by which means he hoped to secure invariably the desired result.

To ascertain the truth of this reasoning, he instituted a number of experiments upon inferior animals, and actually realized the results which he had anticipated. Since the publication of his paper, the practice he recommended has been extended to the human subject, and in some cases has been attended with the happiest effects; in others, however, it has failed entirely, and has even been productive of the very worst consequences. The length of time necessary for the ligature to remain on the vessel, the inconveniences which result from a wound kept open forty-eight or seventy-two hours, and the doubtful effects of the ligature unless suffered to remain on for that period, are obstacles which must always prevent this practice from being adopted. It therefore remains for future inquirers to discover some means by which that direful malady, aneurism, can be alleviated, without those unpleasant consequences which invariably attend the present mode of operating, if indeed such a result be attainable.

Some years ago Dr. Physick suggested the propriety of an animal ligature, thinking that it would be removed by the absorbents; the external wound might therefore be closed, and all the bad effects produced by the ordinary ligatures thus obviated. We cannot say positively what has been the result of this practice, but believe that the animal ligature is not used so much as its importance demands.

The same gentleman has likewise suggested the use of leaden ligatures, with the view of obtaining such results as were hoped for from his animal ligature, or the temporary one of Dr. Jones. To this he was led by a knowledge of the fact, that bullets, buck-shot, and lead would remain in contact with almost any tissue of the body, without producing irritation or unpleasant consequences, and that for an indefinite period. So far as I know, a trial of this ligature has never been made; with a view, therefore, to ascertain its effects, I have instituted a number of experiments, the results of which I will now relate.

Experiment I.—On the 16th of May, 1828, I laid bare the right carotid artery of a dog, and, after separating it carefully from its accompanying nerve and vein, I passed under it a lead wire, and tied it firmly. Both ends of the wire were then cut off with a pair of scissors, and the sharp points bent down with a common dissecting forceps. The wound was now drawn together with a few stitches of

the interrupted suture, and over these were laid some adhesive strips. This animal was not confined, but suffered to run at large: when I examined him several days after, I found the stitches ulcerated out, and the wound open; it had filled up from the bottom with granulations, but the edges of the skin were separated to a considerable distance: with light dressings, it healed entirely by the 5th of June.

June 28th.—I killed this animal and dissected with care the neck. A small cicatrix existed in the skin; the lead was found in the situation in which I had placed it, by the side of the vein and nerve, perfectly encysted; the artery at this place had been removed entirely, for the space of half an inch.

Both ends of the vessel, caused by this removal of its central portion, adhered by loose cellular substance to the surrounding parts, which appeared to be in a perfectly natural state. The end towards the heart was not at all increased or diminished in size; it was sealed up for three-eighths of an inch in extent, by an organized substance, resembling a coagulum of blood in colour, but not in consistence, it being much firmer. The end towards the head resembled the one just described, in all particulars: the substance, however, which filled its extremity was of greater extent, and occupied the whole space up to the next branch, which was rather more than half an inch.

Not the slightest trace of inflammation existed in the neighbouring parts, on the contrary, they appeared perfectly natural. The lead itself was enclosed in a dense cellular substance, which formed for it a complete cyst.

Experiment II.—The right carotid artery of another dog was separated from its contiguous parts, on the 17th of May, and a lead wire placed around it, as in Experiment I. The lips of the wound were kept in contact with sutures and adhesive strips. I examined it three days after, and found that it had united by the first intention, in the whole of its course, except in those points included by the stitches; these I cut loose, and dressed it simply with adhesive strips. When I looked at this dog again, I found that from the itching of the wound, the animal had scratched off the dressings, and broken up the new adhesions; I washed it carefully to remove the dirt, and dressed it with simple dressings. It healed kindly, and was entirely well on the 6th of June, at which time I killed the dog, and made a careful dissection of the parts. The cellular substance here was much thickened and indurated, forming a strong bond of union between the nerve, vein, and artery. The two former were in their natural condition; the artery was pervious its whole extent, to within three-

eighths of an inch of the wire: at this place the calibre was entirely obliterated; a firm substance, resembling bruised muscle, filled its cavity; between the ligature and the head, the artery was impervious, and much diminished in size, having the appearance of a mere cord, not exceeding one-fourth the original dimensions of the vessel. The lead preserved its situation around the artery; it had become entirely encysted, and not the slightest remains of inflammation existed.

Experiment III.—I cut down on the left carotid of a third dog, on the 29th of May, and proceeded as in Experiments I. and II. differing in no respect, except in dressing the wound: I used no stitches, but merely adhesive plasters.

June 1st.—I examined the wound, and found that it had united through its whole extent, but as I supposed the union not to be very firm, the strips were reapplied, and suffered to remain on until the 5th, when they were removed altogether.

June 27th.—The animal was killed and a minute examination made. The lead wire was found around the vessel, which was impervious for an inch or more, as in the former experiments. The surrounding parts healthy.

Experiment IV. June 9th.—The dog which was the subject of the last experiment, having entirely recovered from the first operation, now became the subject of a second, which was performed on the carotid of the opposite side. This was conducted exactly as the preceding; the wound united by the first intention without the least difficulty; no constitutional symptoms manifested themselves. On the 27th, at which time this dog was killed, an examination was likewise made of this side of the neck; the appearances corresponded exactly with those of the preceding experiments.

Experiment V. August 5th.—I performed a similar experiment on the carotid of another dog. I killed him on the 3d of September, and found that the appearances differed in no respect from the foregoing.

The lead having answered my expectations so well in these cases, I felt a great inclination to ascertain, whether that substance alone possessed the property of remaining in contact with the living tissues, without exciting irritation or any unpleasant consequences, or whether similar results might not be obtained by using the other metals. I accordingly continued the subject, using gold, silver, and platinum, instead of lead.

Experiment VI. August 12th.—The right carotid of a dog was separated neatly from its surrounding parts, and tied firmly with a small gold wire; the wound was kept closed with adhesive strips, and by the third day had united firmly. *Sept. 2d.* The dog was killed,

and I examined his neck; I could perceive no difference in the appearances exhibited here, from those produced by the lead.

Experiment VII. October 13*th.*—I exposed the left femoral artery of a dog, and placed around it a gold wire. 15*th.* I examined this dog, and found that from his restlessness he had removed the dressings and had torn open the wound; I replaced them, and he recovered in a short time. *Oct.* 30*th.* I examined the subject of this experiment, and found that the results corresponded in every particular with those above related.

Experiment VIII. October 16*th.*—The above experiment was repeated on this dog; the wound healed very kindly by the first intention, &c. *Oct.* 30*th.* I found the result to coincide with the last in all particulars; there was a slight appearance of ecchymosis around this ligature, which, no doubt, would have been removed in a few days more, only fourteen days having elapsed between the operation and the examination of the result.

Experiment IX. October 5*th.*—I passed around the carotid of a dog, a piece of silver wire, and united the wound by the first intention, which had taken place on the 9th, at which time I examined it. *Oct.* 30*th.* I found that the silver had become encysted, and had left no remains of irritation.

Experiment X. October 5*th.*—The same experiment on another dog. 30*th.* The results the same.

Experiment XI. October 13*th.*—I passed a silver wire around the right femoral artery of a dog. 15*th.* Wound healed. 30*th.* Wire encysted. No traces of inflammation remaining.

Experiment XII. August 29*th.*—I cut down on the left carotid of a dog, and passed around it a platinum wire. This animal made his escape, and I did not see him again until the 16th of October, when I examined his neck; the wound had united so nicely that its former situation could scarcely be recognise; the cellular substance beneath was slightly thickened and indurated; the artery was obliterated for an inch and a half or two inches; the middle portion resembled a small cord, around the centre of which, I found the platinum wire enclosed in a mass of condensed cellular substance, which formed for it a cyst; the inside of this cyst was smooth, and adhered closely to the platinum; no traces of inflammation remained.

Experiment XIII. October 15*th.*—Another dog was subjected to an experiment resembling the above in all particulars. *Oct.* 30*th.* I killed him and found no other difference in the appearances, than that the cyst which enclosed the platinum, was not so perfectly formed; it however existed.

Experiment XIV. October 16th.—This experiment was conducted precisely as the two last; the appearances upon examination were the same. This dog was the subject of Experiment VII. and was examined on the 30th of October.

Experiment XV. June 15th.—I enclosed the humeral artery of a dog in a ligature made of a single stran of silk, previously waxed. In applying the ligature, I drew it barely tight enough to place the opposite sides of the vessel in contact, without dividing the internal and middle coats. Both ends were then cut off, and the lips of the wound placed in apposition; it did not unite, however, by the first intention, the dressings having been removed by the animal; it was now dressed in the usual way, and soon healed perfectly by granulations. On the fourteenth day after the operation, I made a dissection of the parts: the artery was filled with a firm coagulum, both above and below the place of the ligature, which prevented the possibility of hæmorrhage, so firmly did these coagula adhere to the parietes of the vessel.

The ligature was found in the centre of a small *abscess*, loose and detached from the surrounding parts; the artery was ulcerated through, the ends being separated a short distance.

Experiment XVI. August 15th.—I repeated this experiment on the femoral artery of another dog; the wound was united by the first intention. *Sept. 2d.*—Upon dissection, an *abscess* as large as a pea, was discovered immediately under the skin and above the artery; the loop of silk was found in its centre, and offered no resistance when I attempted to remove it.

Experiment XVII.—I passed under the femoral artery of a dog a piece of gum elastic, previously stretched and rolled to render it of a proper size, and tied it with a single knot. This operation was performed on the 15th of August; the wound united by the first intention. *Sept. 3d.*—An examination was made of the result of this experiment. The ligature was found encysted; the inner side of the cyst was uneven, and not in close contact with the gum elastic; from its appearance, I thought that pus had existed, but was now absorbed; the artery was obliterated to the next branch, both above and below.

Experiment XVIII. August 20th.—The same experiment repeated on the right carotid of another dog. *23d.*—Perfectly united by the first intention. *September 2d.*—The gum elastic was found contained in an abscess as large as half a nutmeg; the artery was impervious both above and below the ligature, and ulcerated through at the place of its application.

Experiment XIX. September 1st.—The experiment with gum elas-

tic was repeated on the femoral artery of another dog, and the wound united in the usual manner. This dog was the subject of Experiment XII.; consequently I had not an opportunity of examining him until the 16th of October, when he was again caught. The cicatrix in the skin was to be seen plainly. On making an incision at this place, I perceived a small lump, about the size of a pea, immediately under the skin, and at the lower angle of the wound. I opened this and found it to contain the gum elastic ligature, surrounded by a small quantity of yellowish-looking pus; the vessel was removed for the space of an inch and a half, both ends obliterated. Just above the place of the ligature, several small arteries, not distinguishable in the healthy condition of these parts, were observable, and appeared to be spent upon the contiguous muscles.

Experiment XX. August 25th.—I cut down on the left femoral artery of a dog, and tied it firmly with a grass ligature, such as is used for fishing-lines. *27th.*—It had healed by the first intention. *September 2d.*—The grass was found encysted, but the inner side of the cyst was moist and uneven, and did not appear to embrace the ligature closely; no appearance of inflammation.

Experiment XXI. August 25th.—The same operation performed on another dog. *September 3d.*—It was examined and found to correspond with the twentieth in every particular.

From the experiments now detailed, we may, I think, conclude, that the plan of tying arteries with lead and the other metals, is free from danger, and may be productive of some peculiar advantages; more experience, and a greater number of experiments are necessary to establish this point thoroughly, and it is to be hoped that some one fully competent to the task, will prosecute the subject.

Art. II. *Reports of Cases of Erysipelas, treated at the Baltimore Alms-house Infirmary, showing the countervailing influence of that disease over other affections existing in the system at the time of its invasion, with Observations.* By Thomas H. Wright, M. D. Physician to the Institution.

From some cause, not satisfactorily definable, Erysipelas, in various forms, has for fifteen months prevailed among the patients of the Baltimore Alms-house. During this period, the disease has never been wholly absent, but the cases have been commonly single, and never